Title
ELECTRON CAPTURE HALF-LIFE OF Cm243

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Publication Date
1957-12-01

UCRL UCRL-8098

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Radiation Laboratory
Berkeley, California

Contract No. W-7405-eng-48

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December 1957

Printed for the U. S. Atomic Energy Commission

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Calculations of closed decay-energy cycles[1] predict equal masses for Am^{243} and Cm^{243}, leaving unresolved the direction of beta-decay emission between these neighboring isobars. A previous attempt to milk Am^{243} from a sample of Cm^{243} produced negative results and a lower limit of 50,000 years was set for the electron-capture half-life of Cm^{243}.[2] However, that experiment was performed in the presence of relatively large amounts of Am^{241} and with cruder chemical separation techniques than are presently available. For the present investigation, a sample of curium was used that had been prepared by successive neutron capture in Am^{241} using the NRX reactor. The curium was purified initially in March 1951, and this plus later purifications ensured complete removal of all americium isotopes from the curium.

Following a growth period of almost ten months after the last purification, the curium was milked for Am^{243}. Isotopically pure Am^{241} was added as a chemical-yield tracer prior to the separations. Three successive elutions from Dowex-50 cation resin using ammonium alpha-hydroxyisobutyrate as eluant[3] were necessary for removal of all the parent curium. The americium fraction was then electroplated by a previously described method[4] to obtain a thin sample for pulse-height analysis. The ratio of Am^{243} to Am^{241} was determined in a 50-channel differential pulse-height analyzer and the total amount of Am^{243} calculated from the initial amount of Am^{241} activity added.

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Table I gives the relative activity intensities of the curium isotopes obtained from an alpha-particle spectrograph[5] and the relative weights obtained from a mass spectrometer.[6]

Table I

Isotope	Relative activity	Relative weights
Cm^{242}	1.00	----
Cm^{243}	3.01	2.43
Cm^{244}	1.95	1.00

These data can be used with the best value for the half-life of Cm^{244} (18.4 ± .5 years[7]) to obtain an alpha half-life for Cm^{243} of 29.0 ± 0.8 years.

In a similar manner the electron-capture half-life of Cm^{243} can be calculated from the expression

$$t_{1/2\ 63} = 0.693\ \Delta t\ \frac{N_{63}}{N_{53}},$$

where Δt represents the time of Am^{243} growth (0.821 years), 63 refers to Cm^{243} and 53 refers to Am^{243}. N_{63} was obtained by use of the 29.0-year value given above and N_{53} by use of a value of 7951 ± 48 years[8] for the Am^{243} half-life. From 2.2×10^{7} d/m of Cm^{243m}, 4.10 d/m of Am^{243} was milked. The half-life calculated for electron capture in Cm^{243} was $1.1 \pm 0.1 \times 10^{4}$ years. The errors reported are based upon the estimated half-life errors in Cm^{244} and Am^{243} and the errors in counting and assaying.

This work was performed under the auspices of the United States Atomic Energy Commission.

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